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ORIGINAL PAPER

Non-timber forest products and household incomes in Bonga forest area, southwestern Ethiopia

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Abstract: We identified the major non-timber forest products (NTFPs), their contributions to household incomes, and the determinants influencing engagement of households in using NTFPs in the Bonga forest area of Gimbo and Decha Districts of Kaffa Zone, southwest Ethiopia. Six *Kebeles* (the lowest administrative unit in Ethiopia) were sampled from two Districts and 150 households were randomly sampled using proportional-to-size techniques based on the number of farm households in each *Kebele*. Secondary data were collected from and focus group discussions were conducted with selected individuals. The farmers diversified livelihood activities such as crop and livestock production, collection of NTFPs and off-farm activities. NTFPs played a significant role in household incomes. The contribution from the major NTFPs (forest coffee, honey and spices) accounted for 47% of annual household income. The role of NTFPs was influenced by a number of factors. Variables including being native to the area (+), total land holding (+), possession of livestock (+) and access to extension (+) significantly affected forest coffee production. Age of household head (-), land holding (+) and distance of the market from the residence (-) significantly affected honey production. Size of landholding (+), distance to market (-) and distance of the forest from the residence (-) were significant variables determining the NTFP incomes derived by the households. Attention is needed in the design of policies and strategies for the well-being of households to the contribution of NTFPs to local incomes and the variables that affect the collection of NTFPs must be considered.

Keywords: Bonga forest, determinants of NTFP collection, household income, livelihood activities, NTFPs

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Introduction

Forest resources are among the natural resources that have substantial socio-economic, cultural and ecological importance. They are important for soil and water conservation, watershed protection, nutrient recycling, nitrogen fixation, amenity and recreation, creation of microclimate, wildlife habitat, gene conservation and carbon sequestration from the atmosphere (Roper 1999; Teketay 2004 and 2004–2005). They are also the sources of timber and non-timber forest products (NTFPs).

NTFPs are numerous and versatile (Agustino et al. 2011). They comprise unprocessed raw materials and consumer products as well as further processed consumer or industrial goods. In the African context, NTFPs have several functions, including food production and food security, health security, house construction materials, household and agricultural tools. They are also important in income generation through harvesting, processing and trading in products such as gums, resins, oils, leaves, fruits, fodder, honey, mushrooms, tanning materials, bush meat, medicine and eco-tourism (FAO 1995 and 2001; Arnold 1995; Agustino et al. 2011).

Because of their crucial importance, NTFPs received considerable attention in the last decades (FAO 1995, 2001; Arnold 1995; Chikamai and Tchatat 2004; Agustino et al. 2011; Heubach et al. 2011). Arnold and Ruiz Pérez (2001) reviewed reasons why NTFPs attracted so much attention and outlined three propositions. The first is that NTFPs contribute significantly to the livelihoods of households living around the forest. The second is that exploitation of NTFPs is ecologically less destructive than timber harvesting. In other words, what makes NTFPs different from timber and important to conservation is the assumption that the forests will remain standing and, more or less, biologically intact under sustained harvesting of NTFPs (Neumann and Eric

2000). The third is that increasing the value of NTFPs earned by local people provides incentives for conserving forests.

NTFPs are important parts of the economy of most countries, both developed and developing. They are generally well known worldwide to support many local communities (Chikamai and Tchatat 2004; Agustino et al. 2011; Heubach et al. 2011). NTFPs provide subsistence goods such as food, medicines and building materials, and form a safety cushion in times of economic hardship (Ros-Tonen and Wiersum 2003). In addition to food and medicine, sales from NTFPs furnish supplementary seasonal incomes to households, more especially in times of dwindling economic activities, such as low crop productivity and drought (Dovie 2010). While NTFPs contribute to household income in many countries, this contribution is uneven geographically and socially. In India, for instance, over 50% of forest revenues and 70% of forest export income are derived from NTFPs (Shiva 1993). In Sri Lanka, NTFPs provide a value equivalent to $253 in cash per year per family or 16.2% of total income (Neumann and Hirsch 2000).

Some studies (Seyoum 2007, Adilo 2007, Sultan 2009) demonstrated the value of NTFPs to the rural societies in Ethiopia. These studies indicated that most rural households use NTFPs for different purposes such as food, medicine and sources of income. However, more studies are needed from a greater diversity of areas to develop reliable national statistics on the contributions of NTFPs in Ethiopia (Sultan 2009). The estimation of benefits from NTFPs can be an indicator of their contribution to household and the national incomes. Recognition of the contribution of NTFPs to household incomes is important for quantifying the share of forest resources in national income, which can ultimately contribute to reform of forest policy. However, information is lacking on the role of NTFPs in household incomes and factors that affect engagement of households in the collection of NTFPs in Bonga forest area. This was the basis for undertaking this study.

Our objectives were to identify the major NTFPs of Bonga forest that the local people utilize, determine the contribution of NTFPs to household incomes and identify the factors influencing the engagement of households in the collection of NTFPs.

Materials and methods

Study area

The study was conducted in Gimbo and Decha Districts of Kaffa Zone (where Bonga forest is located), Southern Nations, Nationalities and Peoples Regional State (SNNPRS), southwest Ethiopia. The study area was situated about 454 km away from Addis Ababa and 710 km from Hawassa. The study area covered 218,390 ha at 7° 00′–7° 25′ N and 35° 55′–36° 37′ E (Fig. 1).

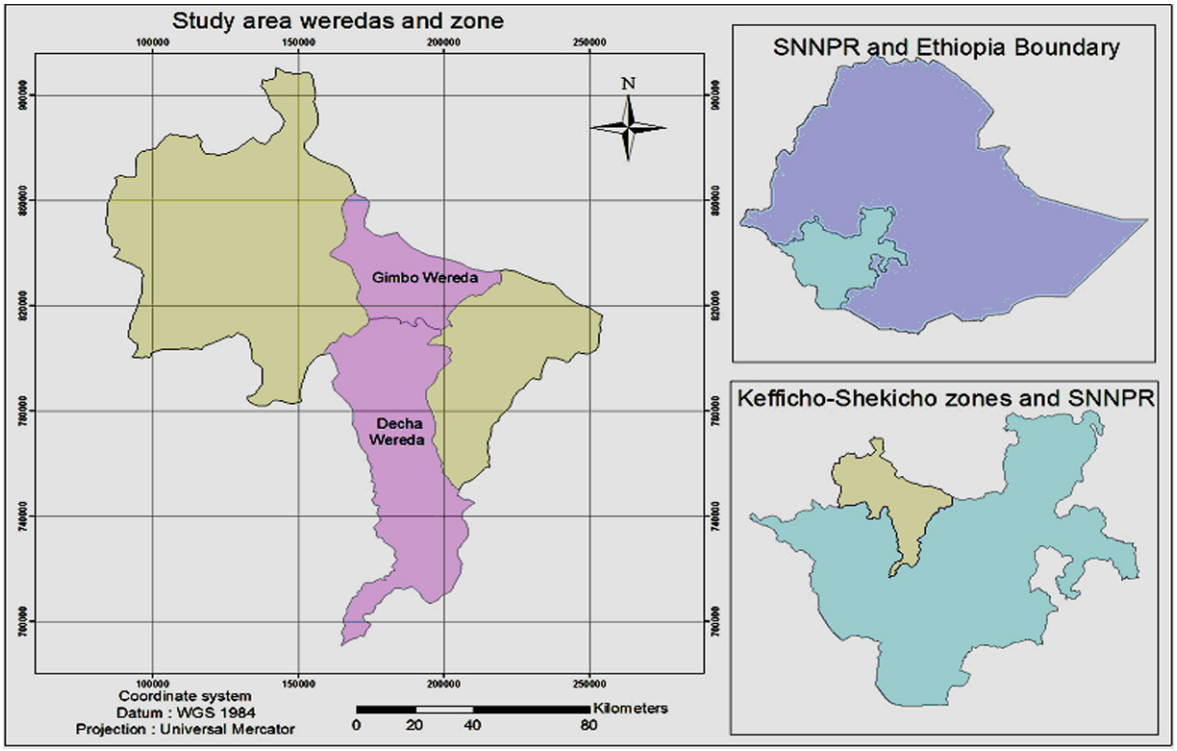

Fig. 1. Maps of the study area

The elevation of the study area ranges from 1,000 to 3,350 m and consists of a highly dissected plateau, with flat to moderately undulating terrain on areas above 1,500 m (Ersado 2001). Of the total area, about 32%, 23%, 6%, 25% and 14% are natural forest, cultivated, grazing, arable and non-arable land, respectively (SNNPR Investment Expansion Process 2010). The mean annual

temperature ranges from 10.1 to 27.5°C and the mean annual rainfall ranges from 1,100 to 2,200 mm (Ersado 2001). The original reported forest cover of Bonga forest was 161,424 ha. Presently, it includes forest land, settlement areas, grazing land and farmland. It stretches across the boundaries of five contiguous districts. Information on the actual size of the present forest area was not available, but it is estimated to be far below the original size (Bekele 2003). The total population of the study area was 219,669 with an average population density of 90 persons per square kilometer. Average family size and annual income were about 6.51 persons and Birr 6,079.00 (= about USD 380.00) per household, respectively.

Data collection

Among five districts encompassed by Bonga forest, two districts of Gimbo and Decha were selected for sampling based on the extent of NTFPs, representativeness and accessibility. From two districts, a total of six *Kebeles* were selected. Several rules-of-thumbs were suggested for determining the minimum number of households required to conduct multiple regression analyses. We adopted the rule-of-thumb that $N \geq 50+8m$, where N is the minimum number of households and m is an explanatory variable (Green 1991). The explanatory variable was eleven. Hence, the minimum sample size was $N \geq 50+8 \times 11 \geq 138$. We sampled 150 farm households that we selected randomly using proportional-to-size techniques and based on the number of farm households in *Kebeles* so that all sample units would have equal chances of being selected.

Both primary and secondary data were collected. Primary data were collected from the study area through a survey of individual households using a structured questionnaire and focus group discussions (FGDs). For the household survey, a structured questionnaire was prepared. The questionnaire was developed based on reconnaissance survey, consultation with different experts and reference to literature.

Information collected using the structured questionnaire was supplemented with FGDs. Individuals who had lived in the area for a long time and had good experience in the use of NTFPs were selected. FGDs were conducted by forming small groups (members of 7–8 persons) with members sharing similar background and experience of the issues under study.

Data analyses

To meet the objectives of the study, both descriptive and econometric analyses were employed. The data collected were analyzed using Statistical Package for Social Sciences (SPSS) version 17 and Excel 2007. Descriptive statistics such as mean, percentage, frequency and standard deviation were employed to analyze the data collected to address the first two objectives.

Econometric models were used to analyze the factors influencing the involvement of households in NTFP collection. Two types of regression analyses were undertaken. In the first analysis, since there was no user of commercial NTFPs, determinants of participation in the collection or use of NTFPs were estimated by using a binary logit model. The logistic function was used because it closely approximates the cumulative normal distribution and is relatively simple from a mathematical point of view and lends itself to meaningful interpretation. The logistic distribution function (Hosmer and Lemshew 1989) for identifying users and non-users of NTFPs was defined as:

$$P_i = \frac{1}{1+e^{-Z_i}} \tag{1}$$

where, P_i is the probability of being user for the ith farmer and Z_i is a function of m explanatory variables (X_i) denoted as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_m X_m \tag{2}$$

where β_0 is the intercept and β_i is the slope parameter in the model. The slope describes the logarithmic change in probability of being a user of NTFPs as independent variables change.

Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean P_i, interpretation of the coefficient will be understandable if the logistic model can be re-written in terms of the odds and logarithm of the odds (Gujarati 2004).

The odds to be used can be defined as the ratio of the probability that a farmer will use (P_i) to the probability that he/she will not use NTFPs (1-P_i).

But

$$1-P_i = \frac{1}{1+e^{Z_i}} \tag{3}$$

Therefore,

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i} \tag{4}$$

and

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{\beta_0} + \sum_{i=1}^{m} \beta_i X_i \tag{5}$$

Taking the natural logarithm of the odds ratio of the equation above will result in what is known as the logit model as indicated below:

$$\ln[\frac{P_i}{1-P_i}] = \ln[e^{\beta_0} + \sum_{i=1}^{m} \beta_i X_i] = e^{Z_i} \tag{6}$$

If the disturbance term U_i is taken into account the logit model becomes:

$$Z_i = \beta_0 + \sum \beta_i X_i + U_i \tag{7}$$

Hence, the above econometric model was used and treated against variables assumed to affect the use of NTFPs. Accordingly, two logistic regression models were developed to explore the key determinants of the likelihood of use of NTFPs, such as forest coffee and honey.

In the second analysis, factors influencing the volume of harvest of NTFPs were estimated by using a multiple linear regressions model (Gujarati 2004, Wooldridge 2005). In this case, income (monetary value) derived from NTFPs was considered as the dependent variable representing the volume of NTFPs harvested. To arrive at the total income derived from NTFPs, the quantity of NTFPs harvested for both commercial and subsistence purposes was multiplied by the market price. The following econometric model was employed:

$$Y = \beta_0 + \beta_i X_i + \varepsilon \quad (8)$$

Where, Y is the income derived from NTFPs, β_i is a vector of estimated coefficient of the explanatory variables and ε is the stochastic disturbance term.

Results

Demographic and socio-economic characteristics of households

Among the respondents, 90% and 10% were male and female household heads, respectively. The average family size of the respondents was 6.5 (Table 1). The average age of the sampled household heads was about 41. About 45% of the respondents were illiterate and the rest attended primary (42%) and secondary (10.7%) schools. The average educational level of the respondents was about 4 years. Most (66%) of the respondents were native to the area and the rest (34%) were migrants/settlers from other places.

Table 1. Household characteristic and land holding (ha) of the sampled households

Household characteristic	Family size	Age (year)	Education (year)	Total land holding (ha)	Cultivated land (ha)	Forest coffee land (ha)
Minimum	2	20	0	0.125	0.125	0.125
Maximum	20	75	12+2	11.25	9	4
Mean	6.5	40.79	3.57	2.9	1.8	0.9
Standard deviation	2.41	13.1	4.45	2.01	1.39	0.73

Land is a major fixed asset of the farmers. Mean, maximum and minimum land holdings of the respondents were 2.9, 11.25 and 0.125 ha, respectively (Table 1). The average cultivated land area was estimated at about 1.8 ha per household. Three types of forest land tenure systems were identified, i.e. state, communal and private (forest coffee). There was no clear understanding among respondents regarding the tenure system of state forest, and some of them considered it as 'open access'. Thus, from the state forest, individuals harvest forest products, mainly, NTFPs. Some of the sampled households (65%) also owned private forest land containing forest coffee. On average, a household had 0.9 ha forest coffee land.

On communal land, the most common system was participatory forest management (PFM) in which farmers were organized in a forest user group, mostly at *Kebele* level, to participate in the management of the forest and share the benefits derived from it. PFM was organized in collaboration between FARM Africa, an international non-government organization, and the Ethiopian Government. The major objective of PFM was to contribute to sustainable forest management through the development of partnership between government organizations and forest-dependent local communities. Members of the groups had their own rules and regulations for sustainable exploitation of forest products. According to management committees of the PFM, harvest of NTFPs is clearly defined as an unregulated benefit to the members. PFM members in need of timber to construct a house must obtain permission from the management committees.

Other important assets of the households were domestic animals. Households owned domestic animals, including cattle, sheep, goats, chickens and others. The average livestock holding of the sampled households was 5.02 Tropical Livestock Units (TLUs).

About 55% of the households obtained credit from different sources. The main sources of credit were Omo-microfinance, the Office of Agriculture and Cooperatives. The agriculture extension service in the area focused on providing basic agricultural training, teaching and demonstration about the use of agricultural inputs, forest development, soil conservation and livestock production. The extension service is offered, mainly, by the Office of Agriculture through its technical experts and development agents at the *Kebele* level. Sometimes, the service is offered by NGOs. About 88% of the respondents received extension services related to forest management and forest products.

Non-timber forest products

The forest in the study area provided the basis for the lives of respondent households through provision of various goods and services. About ten categories of NTFPs used by local communities were identified, namely forest coffee, honey, spices (Ethiopian cardamom and Long paper), farm implements, fuelwood, medicinal and edible plants, bamboo, tool handles, household utensils and others (a climber, *Rhamnus prinoides* L'Herit used as hop to make traditional alcoholic drinks, and feed for livestock) (Table 2). Almost all of the sampled households harvested and used at least one type of NTFP.

Table 2. Major NTFPs and distribution of households engaged in production

NTFPs	Number of sampled households	Proportion (%)
Forest coffee	110	73
Honey	78	52
Spices	56	37
Fuelwood	150	100
Farm implements	144	93
Handles tools and household utensils	90	60
Medicinal plants	72	48
Bamboo	26	17
Edible plants	55	37
Others	126	86

About 84% of the respondents stated that the forest cover of the area was decreasing, while 13% saw no change. According to the respondents, the main causes of forest degradation in the study area were expansion of agricultural land, fuelwood collection, charcoal making, land use change by investors and settlements of people, in descending order of severity.

During the group discussion, land use changes caused by investments were identified as a major contributor to the decline of forest coverage. Investors leased forestland to produce coffee. Most investors also harvest forest products, mainly old and important trees. Most respondents (about 81%) believed that soil erosion, shortage of NTFPs, shortage of fodder for animals and climate change result from the destruction of forests in the study area. This suggested a decline in the benefits derived from the forest by rural communities. In spite of this decline, the local community continues to depend on forest products and NTFPs in particular.

Income sources and their relative contributions to the livelihoods of households

The livelihood activities of households in the study area included crop production, livestock production, harvesting of NTFPs and off-farm activities. However, the main sources of income (cash) for the households were agriculture (crop and livestock production) and collection of NTFPs.

As farming is a common activity of many rural communities, almost all sampled households (about 97%) were engaged in agricultural activities, such as production of cereals, coffee, pulses, *enset* [*Ensete ventricosum* (Welw.) Sheeseman] and others. But, productivity remains unsatisfactory due to small land holding and the lack of improved varieties. Thus, most households grew crops primarily for home consumption. As a result, the contribution of agriculture to cash income of the households was 50% in 2009/2010 (Table 3).

Farmers living near the natural forest depend on it for obtaining many NTFPs and timber. The major NTFPs, namely forest coffee, honey and spices play an important part in household cash income. The mean cash income contribution of NTFPs to annual household income in the 2009/2010 production year was 47% of total income for all sampled households. Agriculture contributed slightly more than NTFPs (50%). In addition, several NTFPs were used for household subsistence. The remaining balance (3%) of household income was contributed by off-farm activities (Table 3).

Table 3. Mean annual household cash income by livelihood activities in 2009/10 (N=150)

Types of income	Average income (Birr/year)	Relative contribution (%)
Agricultural income	3,040.00	50
NTFPs income	2,857.00	47
Off farm income	182.00	3

Among NTFPs, forest coffee contributed most to household incomes at 64%, followed by honey (24%) and spices (12%).

Determinants of participation in forest coffee production

Of eleven explanatory variables hypothesized, four variables were significant at $\alpha = 0.10$. The chi-square test showed the overall goodness of fit of the model at the 1% significant level. The fitted model also correctly predicted 77.6% of the observed values. The significant explanatory variables were being native to the area (NATIVE), size of land holding (LANDHOL), livestock holding and extension service (LIVTLU) (Table 4). The definition of dependent and explanatory variables included in the econometric model and the expected sign are shown in Appendix 1.

Table 4. The maximum likelihood estimates of the binary logit model for forest coffee

Explanatory variables	Coefficient	Standard error	Wald statistics	Odds ratio (e^{β})
Constant	- 1.979	1.210	2.678	0.138
SEX	- 0.159	0.716	0.049	0.853
AGE	- 0.019	0.015	1.521	0.982
FAMSIZE	0.053	0.090	0.341	1.054
NATIVE	0.777***	0.461	2.837	0.777
LANDHOL	0.251*	0.165	2.303	1.285
LIVTLU	0.138**	0.089	2.419	1.148
DISFOREST	- 0.105	0.400	0.069	0.900
INCOME	0.000	0.000	0.192	1.000
DISMARKET	0.373	0.336	1.233	1.451
CREDIT	0.397	0.485	0.670	1.488
EXTENSION	1.289**	0.609	4.487	3.630

-2 Log likelihood =141.151; Omnibus Tests of model coefficients: chi-square =28.938***; Correctly predicted percent = 77.6, N = 150; *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively.

Being native to the area, as hypothesized, had a positive and statistically significant ($p < 0.01$) effect on participation in forest coffee production. With other factors held constant, the likelihood of a household in favor of participating in forest coffee production increased by a factor of 0.777 for those who were native to the area as opposed to non-native households. Total land holding displayed a significant ($p < 0.1$) positive relation to participating in forest coffee production. When other factors were constant, the odds ratio indicated that an increase in land holding increased the probability of participating in forest coffee

production by a factor of 1.285. Livestock holding, though not hypothesized *apriori*, showed a positive and significant (p <0.05) relation to participation in forest coffee production. The odds ratio of 1.148 for TLU indicated that, with the assumption of *ceteris paribus*, the probability of participating in forest coffee production increased by a factor of 1.148 as livestock ownership increased by 1 TLU. The relationship between access to extension services and use of forest coffee was positive and significant (p <0.05). When farmers receive extension advice, the probability of using forest coffee increases by a factor of 3.630.

Determinants of participation in honey production

Binary logistic regression was run to identify factors affecting participation in honey production. The chi-square value showed that the parameters included in the model were, when taken together, significantly different from zero at the 1% probability level. The model correctly predicted 73% of the observed values. Three variables were significant at the 10% probability level. These variables were age of the household head (AGE), size of land holding (LANDHOL) and distance from market to residence (DISMARKET) (Table 5).

Table 5. The maximum likelihood estimates of the binary logit model for honey production

Explanatory variables	Coefficient	Standard error	Wald statistics	Odds ratio (e^{β})
Constant	- 1.627	1.079	2.276	0.196
SEX	0.640	0.695	0.849	1.896
AGE	- 0.018*	0.015	1.423	0.983
FAMSIZE	0.010	0.069	0.019	1.010
NATIVE	0.259	0.402	0.414	1.295
LANDHOL	0.027**	0.111	0.057	0.974
LIVTLU	0.056	0.067	0.684	1.057
DISFOREST	-0.204	0.328	0.387	0.815
INCOME	0.000	0.000	0.201	1.000
DISMARKET	- 1.032***	0.302	11.685	2.807
CREDIT	0.030	0.414	0.005	1.030
EXTENSION	0.223	0.593	0.141	1.249

-2 Log likelihood = 180.678; Omnibus Tests of model coefficients: chi-square = 25.506***; Correctly predicted percent = 73, N = 150; *, **, and *** represents statistical significance at 10%, 5% and 1%, respectively.

As predicted, the coefficient of age of the household head was negatively and significantly (p <0.1) related to the production of honey. The odds ratio in favor of participating in honey production was decreased by a factor of 0.983 for an increase in age of one year. Land holding had positively and significantly (p <0.05) effect on participation in honey production. The odds ratio indicated that as land size increased by one hectare, participation in honey production increased by a factor of 0.974. There was a strong negative and significant (p <0.01) relationship between distance to market and honey production. The odds ratio for this explanatory variable showed that, *ceteris paribus*, the odds in favor of participating in honey production decreased by a factor of 2.807 as the walking distance to market increased by one more hour.

Factors affecting income derived from NTFPs

There were differences in the extent of collection of NTFPs, and different factors affected the income derived from the collection of NTFPs. The F-test of the multiple regression showed that the model was significant at the 1% probability level (Table 6). R^2 of 0.524 indicated the explanatory power of the model. Thus, 52.4% of the variation in the dependent variables was explained by the regression. The household head (SEX), family size (FAMSIZE), being native to the area (NATIVE), total land holding (LANDHOL), total livestock number in TLU (LIVTLU), total income (INCOME), credit (CREDIT) and extension services (EXTENSION) showed positive relation to income derived from NTFPs (Table 6). However, age of the household head (AGE) and distance to forest (DISFOREST) and market (DISMARKET) were negatively related to income derived from NTFPs (Table 6) with only some variables being significant. Of all variables, the regression analysis revealed that three were significant at 10%, 5% and 1% probability levels. These were total land holding, distance to forest and distance to market from households.

Table 6. Factors affecting income derived from NTFPs

Explanatory variables	Coefficient	t-value	Significance
Constant	3202.98	1.546	0.125
SEX	832.06	0.617	0.538
AGE	- 31.30	- 1.148	0.253
FAMSIZE	134.79	0.930	0.354
NATIVE	612.50	0.762	0.447
LANDHOL	365.44	1.671	0.097*
LIVTLU	109.30	0.794	0.428
DISFOREST	- 283.76	- 0.413	0.040**
INCOME	0.100	1.313	0.192
DISMARKET	- 1522.39	2.703	0.008***
CREDIT	1230.36	1.453	0.148
EXTENSION	1575.71	1.288	0.200

N = 150, R^2 = 0.603, Adjusted R^2 = 0.524, F = 4.7***; *, ** and *** statistically significance at 10%, 5% and 1%, respectively.

The area of land holding positively and significantly (p <0.1) affected the probability that households would harvest NTFPs and generate additional income. The distance of the forest negatively and significantly (p <0.05) affected the extent of collection and, hence, total income from NTFPs. Distance of the market from the homestead negatively and significantly (p <0.01) affected the extent of total income from NTFPs. When the distance to market was great, transaction costs increased, and households were less interested in harvesting NTFPs.

Discussion

NTFPs and their contribution to the household economy

Rural communities in the study area depend on forest products,

particularly NTFPs such as forest coffee, honey, spices, medicinal and edible plants, bamboo, fuelwood and charcoal, other household utensils and implements. Households use these products as sources of income and for household consumption. Forest coffee, honey and spices were the major sources of income for the sampled respondents whereas fuelwood and charcoal, household utensils, farm implements, medicinal and edible plants were used for household consumption. These findings concur with those of Adilo (2007) who reported that major sources of cash income for households, in absolute terms, were NTFPs, such as forest coffee, honey and spices. Similarly, Taye and Wirtu (2004) reported that most farming communities in southwest Ethiopia were forest dependent. The forest was the major source of livelihoods and subsistence through provision of a variety of NTFPs. Many rural dwellers in tropical regions depend on NTFPs for livelihoods and their cash needs (Ndoye et al. 1998).

Farmers in the study area exploited diverse sources of income, i.e. crop and livestock production, and forest products, mainly, NTFPs. Today, many rural households diversify their livelihoods and combine various strategies to obtain food, consumer goods and income, without focusing on a single activity (Ros-Tonen and Wiersum 2003). Similarly, Paumgarten (2007) noted that livelihood diversification has been identified as a strategy for maximizing incomes from a variety of sources and opportunities as well as a coping mechanism through which households try to spread risk.

Agricultural production was the major source of income (50%) for rural households in the study area. This supports Sultan (2009) and Adilo (2007) who reported that agriculture contributed 44% and 48% of total household income in southeastern and southwestern Ethiopia, respectively.

For such diversified livelihoods, exploitation of NTFPs can play an important role. The collection of NTFPs made significant contribution to the livelihood of the rural people, accounting for, on average, 47% of the total household income. This finding is comparable with other studies (Kramer et al. 1995; Andargatchew 2006; Adilo 2007). Adilo (2007) who conducted research in areas that share similar agro-ecology with our study site, found that NTFPs (mainly forest coffee and honey) contributed to, on average, 49% of total household income. Similarly, Andargatchew (2006) showed that, on average, 47% of the annual income of households was derived from sale of bamboo in Shedem *Kebele* of Goba District, southeastern Ethiopia. Our results are consistent with those of Kramer et al. (1995) in Madagascar and revealed that NTFPs contributed 47% of the total household income.

Taye and Wirtu (2004) report the share of NTFPs to be 73% of gross household annual income in southwestern Ethiopia. This value is much higher than in our study (47%). This might be due to the approaches and methods used as well as price fluctuations.

Income from Oleo-gum resins contributed up to 32% of annual household income in Liban, South Ethiopia (Lemenih et al. 2003). The contribution was 23% of total annual household income for households collecting NTFPs (mostly forest coffee and honey) in Gore, southwestern Ethiopia (Debela 2004). Similarly, Fetene (2006) reported that the sale of NTFPs accounted for 27.4% of household income in Menagesha Suba forest area. Tiruneh and Tafa (2004) reported that the annual average income from NTFPs was less than Birr 1000.00 for households involved in the collection of NTFPs in southwestern Ethiopia. Our study showed higher cash income (up to Birr 2,857.00 per year) from the collection of NTFPs. The difference can be partly explained by the characteristics of respondents and price fluctuations. Studies in South India and Cameroon reported that the contributions of NTFPs to total household income were around 39% and 6%–15%, respectively (Ravi et al. 2006 and Ambrose-Oji 2003), both less than that in our study.

Factors influencing the collection of NTFPs

In our study, variables that showed significant differences for forest coffee collection were being native to the area, total land holding, livestock owned and extension service. Age of household head, land holding and distance to market significantly affected the production of honey. Moreover, total land holding, distance to market and distance to forest were variables that significantly affected income derived from NTFPs.

In line with our findings, Adilo (2007) reported that livestock holding positively affected household decisions to collect and use forest coffee. The positive effect of livestock ownership on forest coffee collection may be because the same labor is used for collecting forest coffee and keeping livestock in the field around the forest. Being native to the area and the use of forest coffee are correlated positively, and Seyoum (2005) reported similar findings. According to Seyoum (2005), native households attributed more value to natural resources and respected rules and regulations in order to gain better access to forest products. Receiving extension services and participating in forest coffee production were positively related. Educating farmers about market opportunities and assisting in local organization of marketing activities encourages extraction of NTFPs (Dewees and Scherr 1996).

In our study, age of respondents negatively affected honey production, suggesting that as the farmers age, they suffer reduced ability to climb bigger trees to hang beehives. Hence, the younger households are more likely to participate in honey production. This concurs with Belay (2005) who reported that most beekeepers were middle-aged even though honey production required skill and maturity.

Total land holding and income from NTFPs were positively correlated, which concurs with Sultan (2009). However, our findings differ from those reported by Ravi et al. (2006) who concluded that area of landholdings had negative impacts on household income from NTFPs. Babulo et al. (2008) also reported that households with large plots of land were less likely to engage in forest extraction as their dominant strategy.

The negative and significant effect of distance to forest on income from NTFPs was expected because the cost of production increases as distance to forest increases. Hegde and Enters (2000) and Paumgarten (2007) noted that the extent of forest resource use was greater in proximal *Kebeles* than in distant

Kebeles, possibly because the proximal *Kebeles* had access to resources, while distant *Kebeles* had very poor access. Sultan (2009) concluded that the reason for this negative relation is that households distant from a forest preferred alternative activities like agricultural over NTFP collection.

Similarly, distance to market significantly and negatively affected income from NTFPs. This was due to the fact that greater distance to market increased transaction costs and this discouraged farmers from harvesting NTFPs. This finding agrees with that of Ros-Tonen and Wiersum (2003) who reported that location matters when it comes to the potential role of NTFPs in people's livelihoods. It is also supported by Debela (2004) at Gore, southwestern Ethiopia, who confirmed that market distance limits the potential of NTFPs to contribute to the income of rural people.

Conclusions and policy implications

The livelihood activities of households in the study area consist of crop and livestock production, forest related activities, mainly, harvesting of NTFPs, and off-farm activities. Within such diversified income sources, exploitation of NTFPs plays an important role. Farmers harvest NTFPs from the forest for different commercial and subsistence purposes. The income derived from the sale of NTFPs demonstrates that the forest plays an important role in household incomes. Most NTFPs (forest coffee, honey and spices) were collected for sale alone and contributed 47% of annual household income. Thus, households in the forest area use NTFPs both for household consumption and as a source of cash income.

The role that NTFPs played, however, was influenced by a number of factors. Being native to the area (+), total land holding (+), possession of livestock (+) and access to extension (+) significantly affected forest coffee production. Variables such as age of household head (-), land holding (+) and distance of the market from the residence (-) significantly affected honey production. Size of landholding (+), distance to market (-) and distance to forest (-) were variables that significantly affected income derived from NTFPs. Factors affecting the collection and use of each NTFP varied. All variables (except land holding) affecting production of forest coffee did not affect honey production and vice versa. Therefore, differences in the above factors should be considered in the design, promotion and implementation of activities related to the collection and utilization of NTFPs.

Based on the findings of our study, we offer the following recommendations:

(1) Income derived from the collection of NTFPs contributes significantly to the annual income of sampled households in the study area. Therefore, policies and strategies that intend to improve the well-being of rural people and natural resource conservation should give attention to the contribution of NTFPs to the livelihoods of local people.

(2) Distance to market affects household decisions to participate in the collection of NTFPs. Thus, policies or strategies aimed at improving marketing facilities for NTFPs and market infrastructure should be priorities.

(3) Provision of extension services related to forest and forest products had a significant positive impact on household participation in forest coffee production. Therefore, extension services should be delivered properly to balance conservation and benefits.

(4) Forest management strategies and interventions that are designed to reduce pressure on the forest should consider how best to address deforestation and to achieve sustainability of the resource.

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Appendix 1. Definition of dependent and explanatory variables included in the econometric model and expected signs

Variable code	Description	Types of variable	Unit of measurements	Expected sign
UNTFP	NTFPs use	Dummy	1 = user, 0 = non user	
INCNTFPS	Total income derived from NTFPs	Continuous	Measured in Birr	
SEX	Sex of household head	Dummy	1 = Male,0 = Female	+/-
AGE	Age of household head	Continuous	Measured in years	-
FAMSIZ	Family size	Continuous	Number	+
NATIVE	Household head being native to the area	Dummy	1 = Yes, 0 = No	+
LANDHOL	Total land holding of household head	Continuous	Measured in hectare	-
LIVTLU	Livestock holding of a household head	Continuous	Measured in tropical livestock unit (TLU)	+/-
DISFOREST	Mean distance of forest from residence	Continuous	Measured in walking hours	-
INCOME	Total household income	Continuous	Measured in Birr	-
DISMARKET	Mean distance of market from residence	Continuous	Measured in walking hours	-
CREDIT	Access to credit	Dummy	1 = Yes, 0 = No	+